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DESIGN AND QUALIFICATION TESTING OF THE CNU-538/E CONTAINER FOR THE F-15 CANOPY

HQ AFMC/LGTP
AIR FORCE PACKAGING EVALUATION ACTIVITY
WRIGHT-PATTERSON AFB, OH 45433-5999
November 1992

PROJECT NO. 91-P-117
TITLE: F-15 Canopy Container, CNU-538/E

ABSTRACT

The objective of this project was to design a new shipping/storage container to replace the wooden container currently used for the F-15 Canopies. The new container would store either the one man canopy or the two man canopy, prevent deformation of the canopies, and have a longer life cycle with less maintenance to the container and canopies. The container designed, CNU-538/E, is a reusable, welded aluminum, controlled breathing style container for level A packaging. The CNU-538/E container was tested to qualify the container for production release by the Air Force Packaging Evaluation Activity. The design and tests were in accordance with MIL-STD-5584, MIL-STD-648, and FED-STD-101 and completed at the Air Force Packaging Evaluation Activity, Wright-Patterson AFB OH 45433-5999.

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TABLE OF CONTENTS

PAGE

Abstract.....i
Table of Contents.....ii
Introduction.....1
Design.....1
Testing.....2
Orientation.....2
Instrumentation.....2
Test Procedure.....2
Test Descriptions, Equipment, and Results.....3

a. Examination of Product.....3
b. Weight Test.....3
c. Form and Fit Test.....3
d. Leak Test.....3
e. Resonance Strength and Dwell.....4
f. Repetitive Shock.....4
g. Rough Handling.....5
h. Stacking.....8
i. Mechanical Handling Test.....9
j. Cover Standoff Test.....9
k. Gasket Pull Test.....9
l. Handle Strength Test.....10
m. Handling Provisions Test.....10
n. Structural Integrity.....10

Conclusions.....11

APPENDICES

Appendix 1: Figures.....12
Appendix 2: Sample Test Data.....18
Appendix 3: Test Plan.....23
Appendix 4: Cost Cycle Analysis.....34
Appendix 5: Distribution List.....39
Appendix 6: Report Documentation.....44

INTRODUCTION:

Warner Robins Air Logistic Center (WR-ALC), the depot maintenance activity for the F-15 aircraft, identified a problem with the one and two man canopies in Jul 91. The canopies were elongating and deforming in their wooden shipping/storage containers. Once deformation occurs, the canopy glass must be scrapped and replaced with a new piece of glass at a cost of $13,000. It was determined by WR-ALC that the deformation was caused by humidity being absorbed into the glass. WR-ALC requested the Air Force Packaging Evaluation Activity (AFPEA) to develop a new shipping/storage container that would eliminate the humidity problem.

DESIGN:

AFPEA met with WR-ALC to develop a list of requirements that would meet the users needs. The list is as follows:

a. Dehumidify
b. Sealed
c. Long life (20 years)
d. Low maintenance
e. Shock resistance less than 110 g's
f. Stackable up to 16 ft.
g. Removable handling frame
h. Ship/store both one man and two man canopies
i. Quick release latches
j. Forklift and hoisting capabilities

AFPEA designed a container that met all of WR-ALC needs. The container is an aluminum, controlled breathing, sealed, reusable container. Dehumidification is controlled by desiccant. A desiccant port is provided for easy replacement of desiccant and a humidity indicator is provided to alert users when to replace/reactivate desiccant. A silicone rubber gasket is used between the cover and base to seal the container. Interlocking stacking pads allow stacking of containers. The removable handling frame can accommodate either canopy. The base is doubled walled to protect item from forklift punctures. The container is not painted which reduces original cost of the container, environmental hazards, and maintenance. Shock and vibration isolation is provided by 4 pound per cubic foot (pfc) polyethylene foam cushions adhered to the cover and base.

AFPEA built a prototype container, figures 1 & 2, in-house for testing. Testing covered vibration, impact/shock, environmental sealing, and handling. The test plan was prepared by AFPEA from MIL-STD-648 and FED-STD-101. See Appendix 3 for complete test plan.

TESTING:

ORIENTATION:

The F-15 canopy was mounted in the container with its forward end facing the desiccant port. The container faces were identified with a number. The numbering system is as follows:

Numbered Side	Designated Side
1	Top
2	Fwd
3	Bottom
4	Aft (desiccant port)
5	Left
6	Right

INSTRUMENTATION:

Both the single man and the two man canopies were instrumented with one triaxial accelerometer mounted as close to the center of mass of the respective canopy as was practical. The orientation of the accelerometer axes were identical for each canopy. Accelerometer location is shown in figure 3. An example of the acceleration pulses recorded for each test sequence is reproduced in Appendix 2. All signals have been electronically filtered using a two pole Butterworth filter with a 290 Hz cutoff frequency.

Accelerometer orientation

X axis - directed along canopy length
Y axis - directed along canopy width
Z axis - directed along canopy height

Test Equipment

Item	Manufacturer	Model	Serial#	Cal Exp.
Accelerometer	Endevco	2223D	FE97	
Charge amplifier	Endevco	2740B	FY44	27SEP92
Charge amplifier	Endevco	2740B	FW13	28SEP92
Charge amplifier	Endevco	2740B	FY49	27SEP92
Data Acquisition Sys	GHI Systems	Triad CAT	N/A	N/A

TEST PROCEDURE:

The container and F-15 canopy handling frame were tested first with the one man canopy (test sequences 1-19). After successful completion of these sequences the one man canopy was replaced with the two man canopy and the vibration and rough handling test sequences were repeated (test sequences 3-12).

After each test sequence the container was inspected for exterior damage. The container was then opened and inspected internally for damage to the container, the canopy, and the canopy handling frame.

The acceleration values recorded are for reference only. The test plan does not include maximum G levels as part of the pass/fail criteria.

TEST DESCRIPTIONS, EQUIPMENT, AND RESULTS:

TEST SEQUENCE 1 - MIL-C-5584D, 4.7.1, Examination of Product, and 4.8, Inspection of Packaging.

Visual inspection was made of the actual container. The container was equipped with a pressure relief valve, Schrader 645E6 valve, humidity indicator, desiccant port, 12 latches, 4 tie down rings, 4 cover hoisting rings, stacking pads, and skids. Color, finish, marking, identification, drawings, and inspection of packaging was not examined.

TEST SEQUENCE 2 - MIL-C-5584D, 4.7.10, Weight Test.

Empty container weight was 1007 pounds. The one man canopy weight 225 pounds and the two man canopy weight was 175 pounds. Total gross weight was 1232 pounds.

TEST SEQUENCE 3 - MIL-C-5584D, 4.7.3, Form and Fit Test.

The one man canopy was placed in the handling frame and secured. The canopy and frame was then placed in the container. The canopy and frame demonstrated interface compatibility with the container. The two man canopy was placed in the handling frame and secured. The canopy and frame was then placed in the container. The canopy and frame demonstrated interface compatibility with the container. Operation of the desiccant port, tie down rings, cover hoisting rings and latches was accomplished.

TEST SEQUENCE 4 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Equipment	Manufacturer	Model	Serial#	Cal Exp
Manometer, 0-60in H_2O	Meriam Inst.	30EB25IM	154591	N/A
Halogen Leak Detector	General Elec	42081	9M09	N/A
Vacuum/Pressure Pump	Precision	PV35	22AN6/12	N/A

The container was pressurized initially to +1.50 pounds per square inch (psi) and allowed to stand for a one hour period. The pressure loss cannot exceed .05 psi during this period. The container passed the .05 psi/hr leak rate requirement.

The container was evacuated initially to -1.50 pounds per square inch (psi) and allowed to stand for a one hour period. The pressure loss cannot exceed .05 psi during this period. The container passed the .05 psi/hr leak rate requirement.

TEST SEQUENCE 5 - MIL-STD-648A, 5.3.2, Resonance Strength and Dwell Test, MIL-C-5584D, 4.7.7.1, Vibration.

Equipment	Manufacturer	Model	Serial#	Cal Exp
Vibration Machine	L.A.B. Div.	41012	89003	N/A
Vibration Meter	L.A.B. Div.	487A02	0068	20APR92
Sweep Osc. Servo	Spectral Dyn.	SD114B	528	
Automatic Level Prg.	Spectral Dyn.	SD117A	186	
Filter	Krohn-Hite	3343	1943	N/A
Storage Oscilloscope	Tektroniks	5115	B094122	7NOV92

The container with load was rigidly attached to the vibration platform, figure 4. A sinusoidal vibration excitation was applied in a vertical direction and cyclically swept for 7.5 minutes at 2 minutes per octave to locate the resonant frequency. Input from 5 to 12.5 Hz was at 0.125 inch double amplitude and input from 12.5 to 50.0 Hz was at 1.0 G. A 30 minute dwell test was conducted at the resonant frequency.

The container passed with no visual damage. The resonant frequency was 12 Hz and the typical output on the canopy was 4.4 G's with a 1.0 G input from the table.

TEST SEQUENCE 6 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4.

The container failed the .05 psi/hr leak rate required. It was determined the leakage was occurring at the gasket interface on the corners of the container. It was found that the type of gasket being used would roll up next too the water lip and would not allow the lid sealing surface to seal against the gasket. The welded joints of the container did not leak, therefore, the test was acceptable.

TEST SEQUENCE 7 - MIL-STD-648A, 5.2.2, Repetitive Shock Test, FED-STD-101, Method 5019.1, Vibration (Repetitive Shock) Test, MIL-C-5584D, 4.7.7.3, Repetitive Shock (Superimposed Loads).

Equipment	Manufacturer	Model	Serial#	Cal Exp
Vibration Machine	L.A.B. Corp.	5000-96B	56801	N/A

The loaded container was placed on the vibration table utilizing restraints to prevent the container from sliding off. The table

frequency was increased from zero Hertz until the container left the table surface allowing a 1/16 inch thick bar to be inserted under all points of the container. The desired condition usually occurs around four Hertz and will impart a one G acceleration to the container. This impact condition was maintained for a period of two hours.

The container passed with no visual damage. The input frequency from the table was 4.7 Hz and the typical output on the canopy was 6 G's.

TEST SEQUENCE 8 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4.

The container failed the .05 psi/hr leak rate required. It was determined the leakage was occurring at the gasket interface on the corners of the container. It was found that the type of gasket being used would roll up next too the water lip and would not allow the lid sealing surface to seal against the gasket. The welded joints of the container did not leak, therefore, the test was acceptable.

TEST SEQUENCE 9 - MIL-C-5584D, 4.7.8, Rough Handling (Environmental) Test, Cold Temperature -65° F.

Equipment	Manufacturer	Model	Serial#	Cal Exp
Test Cham -100, 375°F	Tenney Eng		BH1138	
Thermocouple	Omega	650	0016	
Thermometers	Omega	650	0016A	10AUG92

Temperature conditioning, when required, is for a period of at least 24 hours. Subsequent testing is done at ambient conditions on a concrete floor as soon after conditioning as is practical.

TEST SEQUENCE 9A - FED-STD-101C, Method 5005.1, Cornerwise-Drop (Rotational) Test and MIL-C-5584D, 4.7.7.2.1, Cornerwise-Drop (Rotational) Test.

The container was dropped on each of two diagonally opposite bottom corners with a free-fall drop height of 17 inches, figure 5. The container passed with no visual damage. The drop sequence and maximum acceleration values recorded are listed below.

One-man Canopy: Temperature was -22° F.

Cornerwise Drop	Corner 5,4,3 - 21 G
Cornerwise Drop	Corner 2,6,3 - 26 G

Two-man Canopy: Temperature was -48° F.

Cornerwise Drop	Corner 4,5,3 - 34 G
Cornerwise Drop	Corner 2,6,3 - 41 G

TEST SEQUENCE 9B - FED-STD-101C, Method 5008.1, Edgewise-Drop (Rotational) Test and MIL-C-5584D, 4.7.7.2.2, Edgewise-Drop (Rotational) Test.

The container was dropped on each of two adjacent bottom edges with a freefall drop height of 17 inches. The container passed with no visual damage. The drop sequence and maximum acceleration values recorded are listed below.

One-man Canopy: Temperature was -22° F.

Edgewise Drop	Edge 4,3 - 14 G
Edgewise Drop	Edge 5,3 - 43 G

Two-man Canopy: Temperature was -48° F.

Edgewise Drop	Edge 5,3 - 48 G
Edgewise Drop	Edge 2,3 - 25 G

TEST SEQUENCE 9C - FED-STD-101C, Method 5012, Pendulum-Impact Test and MIL-C-5584D, 4.7.7.2.3, Impact Test.

The container was impacted on each of two opposite vertical faces (faces 5 and 6) with an impact velocity of seven feet per second, figure 6. The maximum acceleration values recorded are listed below.

One-man Canopy: Temperature was -22° F.

Pendulum Impact	Face 6 - 11 G
Pendulum Impact	Face 5 - 15 G

Two-man Canopy: Temperature was -48° F.

Channel 3, the vertical (Z) acceleration channel, was inoperative during this sequence of tests. The test sequence was not repeated due to consensus that inclusion of Z-axis G levels would not extend the resultant G levels above the fail criteria of 110 G's.

Pendulum Impact	Face 5 - >50 G (signal clipped, maximum signal level limited to 50 G,s by instrumentation)
Pendulum Impact	Face 6 - 49 G

TEST SEQUENCE 10 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4.

The container failed the .05 psi/hr leak rate required. It was determined the leakage was occurring at the gasket interface on the corners of the container. It was found that the type of gasket being used would roll up next too the water lip and would not allow the lid sealing surface to seal against the gasket. The welded joints of the container did not leak, therefore, the test was acceptable.

TEST SEQUENCE 11 - MIL-C-5584D, 4.7.8, Rough Handling (Environmental) Test, Hot Temperature +140° F.

Reference Test Sequence 9.

TEST SEQUENCE 11A - FED-STD-101C, Method 5005.1, Cornerwise-Drop (Rotational) Test and MIL-C-5584D, 4.7.7.2.1, Cornerwise-Drop (Rotational) Test.

The container was dropped on each of two diagonally opposite bottom corners with a free-fall drop height of 17 inches, figure 5. The container passed with no visual damage. The drop sequence and maximum acceleration values recorded are listed below.

One-man Canopy: Temperature was +144° F.

Cornerwise Drop	Corner 4,6,3 - 27 G
Cornerwise Drop	Corner 2,5,3 - 9 G

Two-man Canopy: Temperature was +145° F.

Cornerwise Drop	Corner 4,6,3 - 26 G
Cornerwise Drop	Corner 2,5,3 - 22 G

TEST SEQUENCE 11B - FED-STD-101C, Method 5008.1, Edgewise-Drop (Rotational) Test and MIL-C-5584D, 4.7.7.2.2, Edgewise-Drop (Rotational) Test.

The container was dropped on each of two adjacent bottom edges with a freefall drop height of 17 inches. The container passed with no visual damage. The drop sequence and maximum acceleration values recorded are listed below.

One-man Canopy: Temperature was +144° F.

Edgewise Drop	Edge 6,3 - 28 G
Edgewise Drop	Edge 2,3 - 19 G

Two-man Canopy: Temperature was +145° F.

Edgewise Drop	Edge 4,3 - 15 G
Edgewise Drop	Edge 6,3 - 37 G

TEST SEQUENCE 11C - FED-STD-101C, Method 5012, Pendulum-Impact Test and MIL-C-5584D, 4.7.7.2.3, Impact Test.

The container was impacted on each of two opposite vertical faces (faces 5 and 6) with an impact velocity of seven feet per second, figure 6. The maximum acceleration values recorded are listed below.

One-man Canopy: Temperature was +144° F.

Pendulum Impact	Face 6 - 11 G
Pendulum Impact	Face 4 - 13 G

Two-man Canopy: Temperature was +145° F.

Pendulum Impact	Face 5 - 29 G
Pendulum Impact	Face 6 - 23 G

TEST SEQUENCE 12 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4.

The container failed the .05 psi/hr leak rate required. It was determined the leakage was occurring at the gasket interface on the corners of the container. It was found that the type of gasket being used would roll up next too the water lip and would not allow the lid sealing surface to seal against the gasket. The welded joints of the container did not leak, therefore, the test was acceptable.

TEST SEQUENCE 13 - MIL-C-5584D, 4.7.6, Stacking.

TEST SEQUENCE 13A - FED-STD-101C, Method 5016.1, Superimposed-Load Test (Stackability, with Dunnage), MIL-STD-648A, 5.7.2, Load Test (Stackability), and MIL-C-5584D, 4.7.6.1, Load Resistance.

A 19200 pound load was applied to the top of the container in a manner simulating the stacking of like containers for a minimum period of one hour, figure 7. The container passed with no visual damage.

TEST SEQUENCE 13B - FED-STD-101C, Method 5017.1, Superimposed-Load Test (Uniformly Distributed, without Dunnage) and MIL-C-5584D, 4.7.6.1, Load Resistance.

A uniformly distribute load of 100 pounds per square foot was applied over the top container surface for a minimum period of one hour, figure 8. The container passed with no visual damage.

TEST SEQUENCE 14 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4.

The container failed the .05 psi/hr leak rate required. It was determined the leakage was occurring at the gasket interface on the corners of the container. It was found that the type of gasket being used would roll up next too the water lip and would not allow the lid sealing surface to seal against the gasket. The welded joints of the container did not leak, therefore, the test was acceptable.

TEST SEQUENCE 15 - MIL-C-5584D, 4.7.5, Mechanical Handling Test.

Equipment	Manufacturer	Model	Serial#	Cal Exp
Forklift Truck 4000 lb	Mercury	4018	117774	N/A

TEST SEQUENCE 15A - FED-STD-101C, Method 5011.1, Par. 6.2, Lifting and Transporting by Forklift Truck.

The stability of the container was tested while being carried on a forklift truck. The container passed with no visual damage.

TEST SEQUENCE 15B - FED-STD-101C, Method 5011.1, Par. 6.5, Pushing.

The pushing ability of the container for sharp or uneven skid components that would hamper movement while sliding container on pavement type surfaces was tested. The container passed with no visual damage.

TEST SEQUENCE 16 - MIL-C-5584D, 4.7.5.1, Cover Standoff Test.

With the container cover resting on standoffs, a load two times the cover weight was placed on its top surface. With the load removed the lid was slid five feet in each of four directions. The container passed with no visual damage to the standoffs.

TEST SEQUENCE 17 - MIL-C-5584D, 4.7.5.3, Gasket Pull Test.

The container gasket joint shall withstand a pull test of not less than 20 pounds static load without any separation. This

test is strictly for first article testing of the manufactured gaskets, therefore, it was waived.

TEST SEQUENCE 18 - MIL-C-5584D, 4.7.4.1, Handle Strength Test.

The cover was lifted with one lift ring. There shall be no permanent damage. The container passed with no visual damage.

TEST SEQUENCE 19 - MIL-C-5584D, 4.7.4, Handling Provisions Test.

TEST SEQUENCE 19A - MIL-STD-648A, 5.8.3, Hoisting Fittings Strength Test.

The container, loaded to five times the gross weight of a single container, was hoisted by all four lift points simultaneously, figure 10, and left hanging for five minutes. There shall be no permanent deformation. The container passed with no visual damage.

TEST SEQUENCE 19B - MIL-STD-648, 5.8.4, Tiedown Strength Test.

Apply a load to each tiedown ring at an angle of 45 degrees downward from horizontal and simultaneously 45 degrees out-board from the container surface. The load shall be three times the loaded container weight, 3696 pounds. This test was waived since the tiedown tester was inoperational.

TEST SEQUENCE 19C - MIL-STD-648, 5.8.5, Single Hoisting Fitting Strength Test.

The container was hoisted at one lift point and left hanging for five minutes, figure 9. There shall be no permanent deformation. The container passed with no visual damage.

TEST SEQUENCE 20 - MIL-STD-648A, 5.5, Structural Integrity.

Equipment	Manufacturer	Model	Serial#	Cal Exp
Manometer, 0-60in H_2O	Meriam Inst.	30EB25IM	154591	N/A
Halogen Leak Detector	General Elec	42081	9M09	N/A
Vacuum/Pressure Pump	Precision	PV35	22AN6/12	N/A

TEST SEQUENCE 20A - MIL-STD-648A, 5.5.2, Pressure Test.

The container was pressurized to +3.5 pounds per square inch (psi) and checked for structural damage. The container passed 3.5 psi pressure test with no visual damage.

TEST SEQUENCE 20B - MIL-STD-648A, 5.5.3, Vacuum Test.

The container was evacuated to -3.5 pounds per square inch (psi) and checked for structural damage. The container passed -3.5 psi pressure test with no visual damage.

CONCLUSIONS:

The container passed all testing and was accepted by WR-ALC in meeting their requirements. The estimated cost for production of this container is approximately $4,560.00 each. The containers will pay for themselves within 3 years with an estimated pay back of return to the Air Force of $288,000.00 in that 3 year time period. This estimate is based on a purchase of 100 containers. The estimate includes first purchase cost, maintenance (container & item) cost, refuse cost, and new purchases cost. See Appendix 4 for complete cost cycle analysis.

APPENDIX 1

FIGURES

Figure 1. Canopy Inside Container.

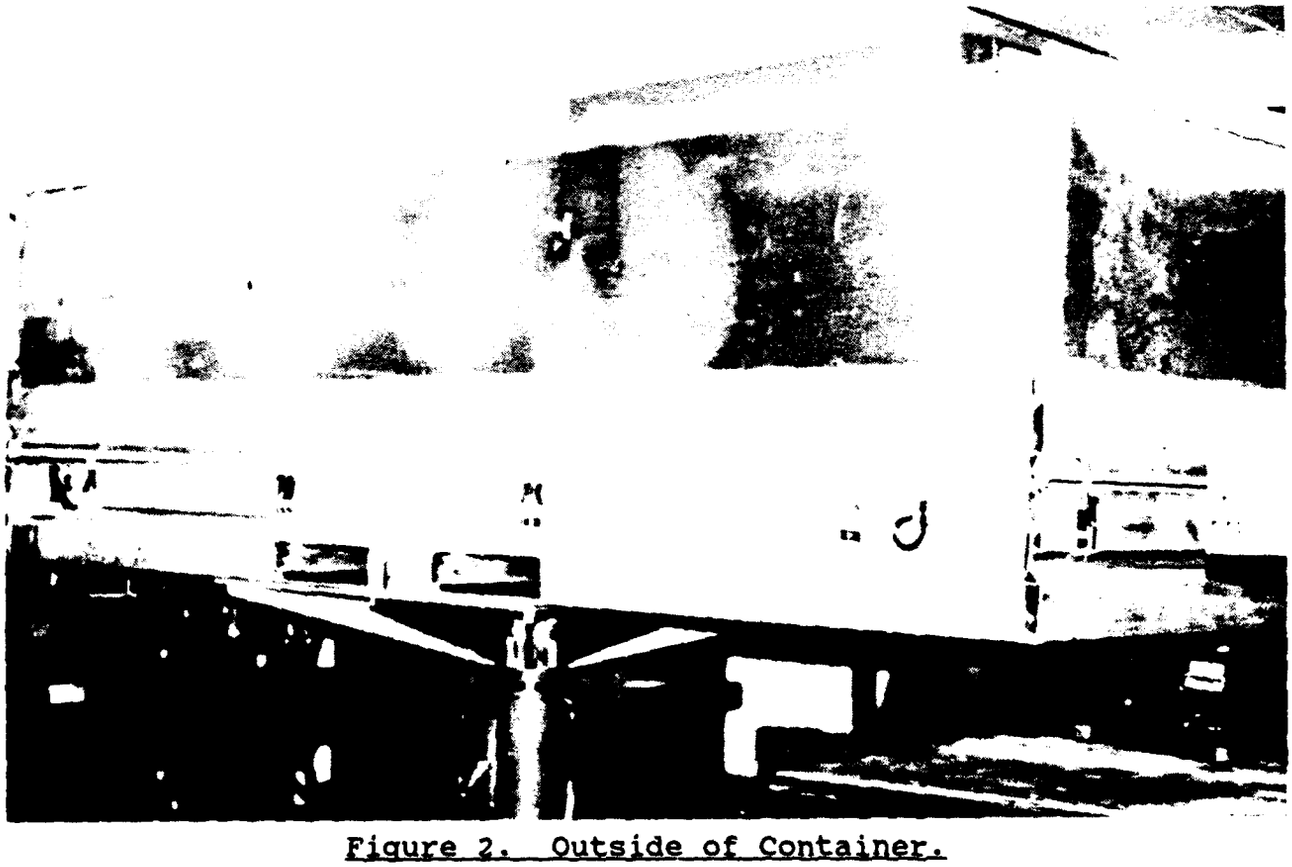


Figure 2. Outside of Container.

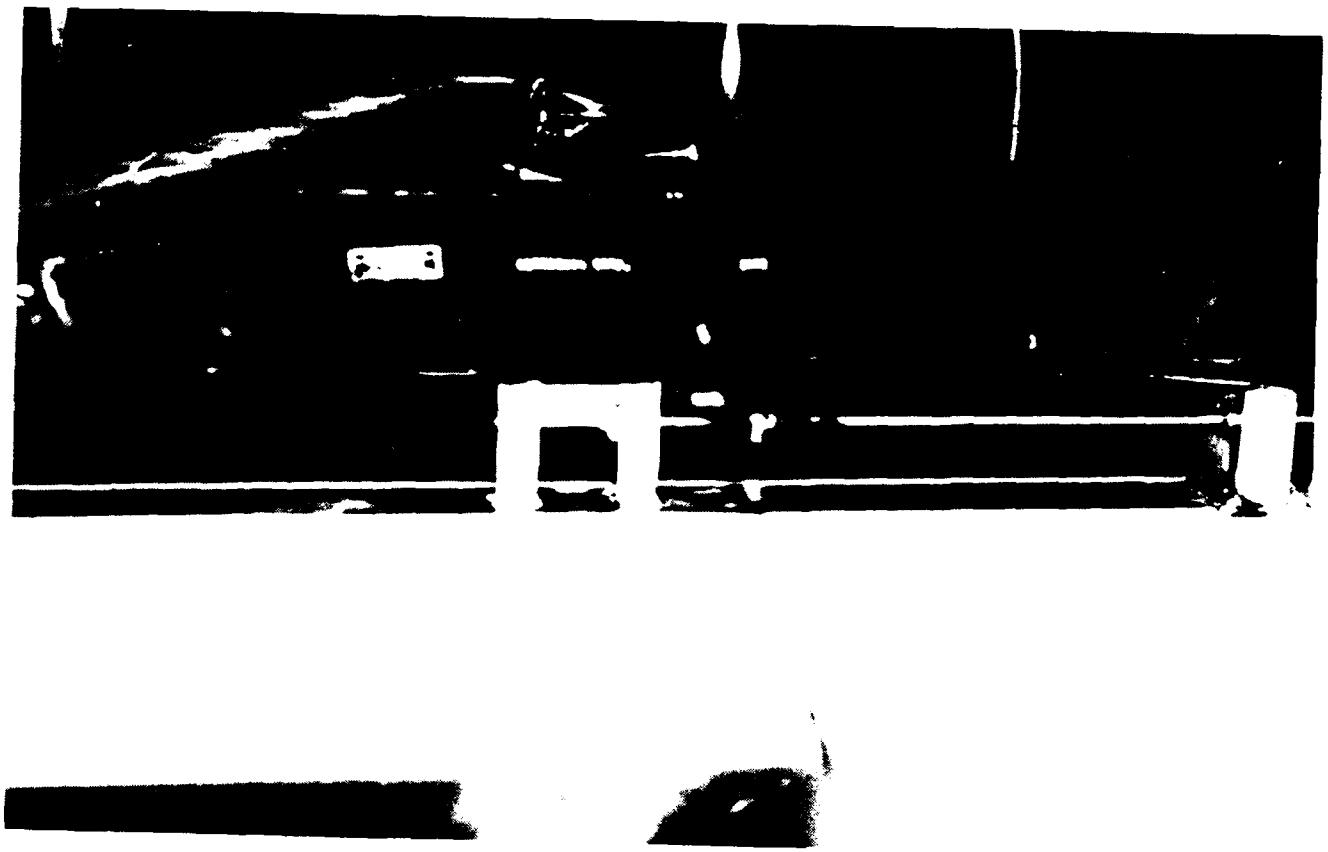


Figure 3. Accelerometer Positioned in Canopy.

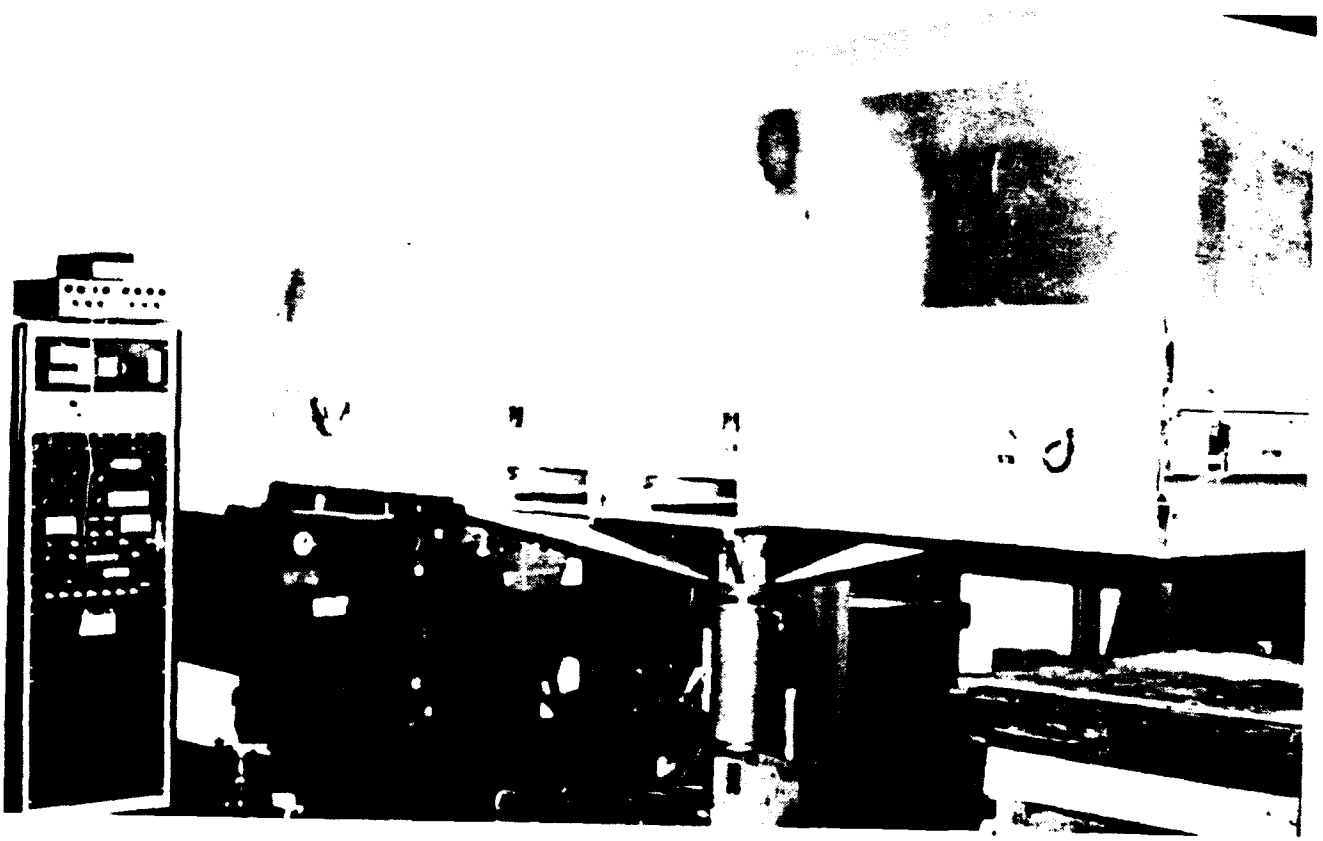


Figure 4. Container During Resonance Vibration Test.

Figure 5. Container During Cornerwise Drop Test.

Figure 6. Container During Pendulum Impact Test.

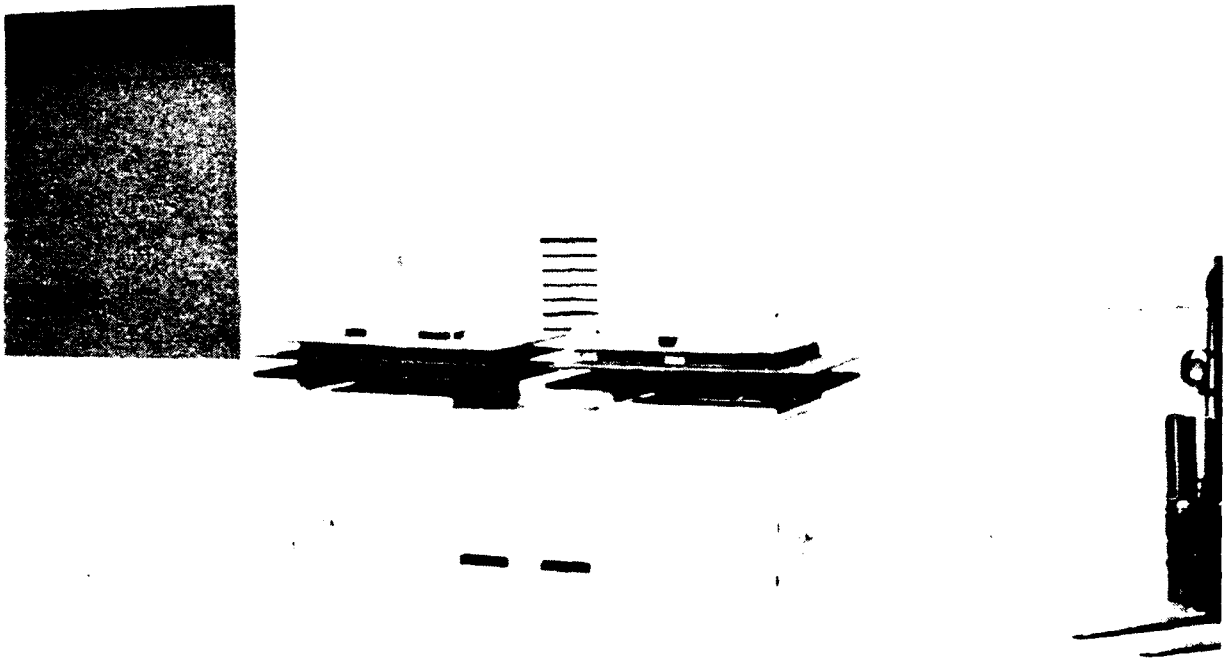


Figure 7. Container During Superimposed Load Test.

Figure 8. Container During Uniform Superimposed Load Test.

Figure 9. Container During Single Hoist Test.

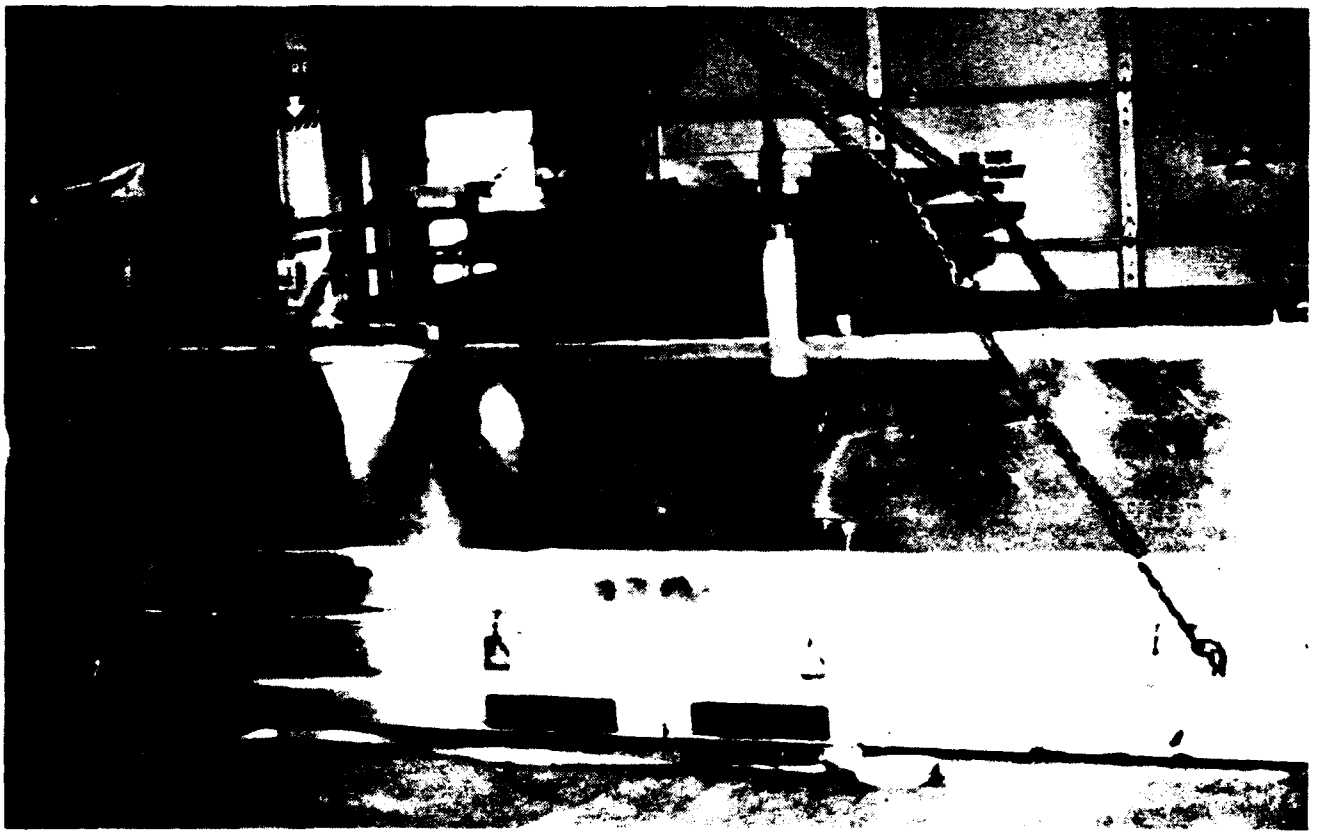


Figure 10. Container During 4 Ring Hoist Test.

APPENDIX 2

SAMPLE TEST DATA

Waveform Test Report

GHI SYSTEMS, INC. TRIAD CAT SYSTEM

Date	: Fri Jan 24 1992	TEST ENGINEER	: Filsinger
TEST ITEM	: f-15 Canopy, 1-man	TEST TYPE	: PENDULUM IMPACT
IMPACT LOC.	: SIDE 4	TEST MACHINE	: 144 deg F

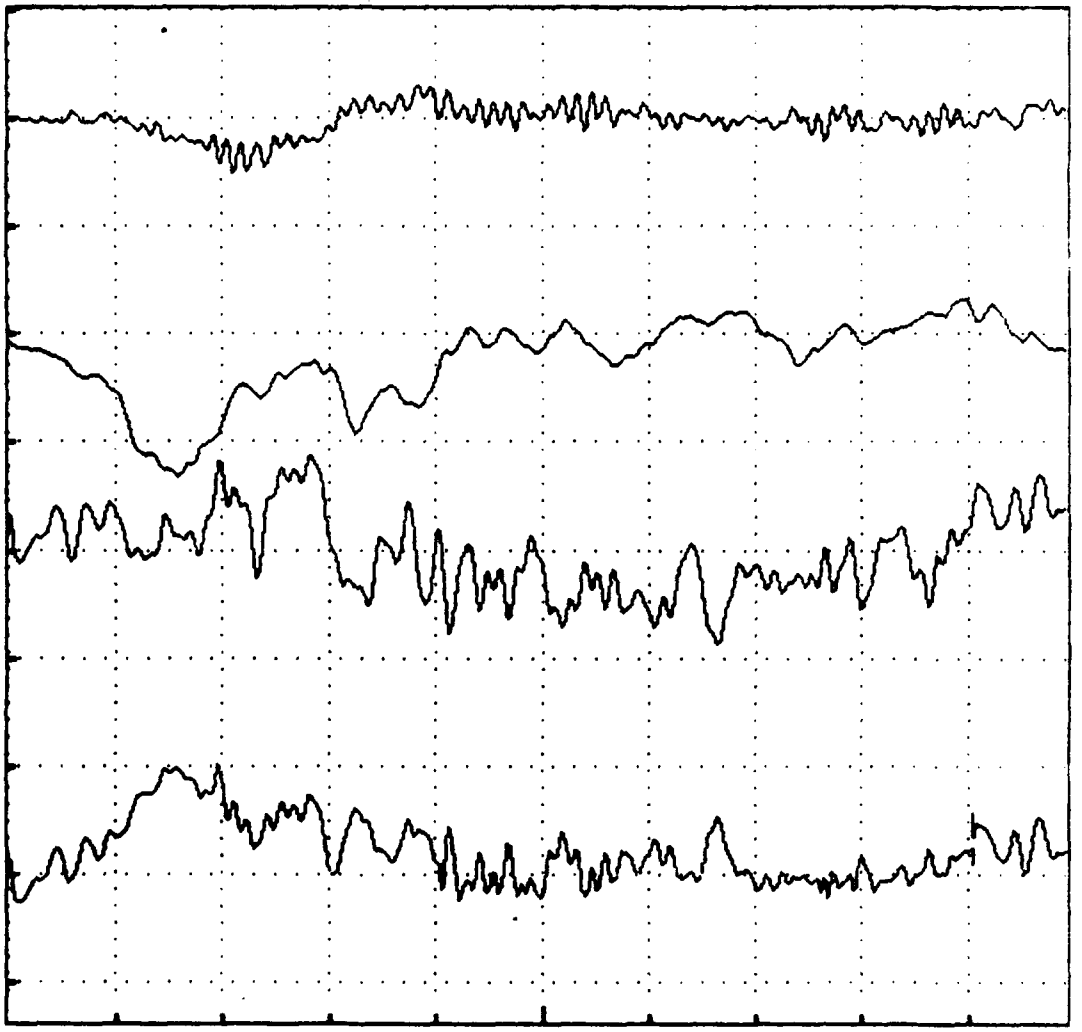
Sensitivity:

Ch. 1: 10.00 g's/Div
Ch. 2: 10.00 g's/Div
Ch. 3: 10.00 g's/Div
Ch. R: 10.00 g's/Div

Filter:

Ch. 1: 300 Hz
Ch. 2: 300 Hz
Ch. 3: 300 Hz
Ch. 4: 300 Hz

Trig. Ch. : ALL
Polarity : Window
Level : 5.98 g's
Mode : Single Event
Pretrigger : 10 %



CH	TIME	CUR AMP	PEAK AMP	1ST INT	2ND INT	TIME/DIV
1	115.71 mS	-0.71 g's	-5.06 g's	-12.24 In/s		12.8 mS
2	115.71 mS	2.67 g's	-12.23 g's	-79.04 In/s		12.8 mS
3	115.71 mS	5.45 g's	9.72 g's	13.24 In/s		12.8 mS
■ R	115.71 mS	6.11 g's	12.91 g's	81.07 In/s		12.8 mS

Remarks

F-15 Container designed to hold 1 or 2 man canopy. One man canopy tested.
Triaxial accelerometer located on top of reinforcing rib at cg in xy plane.
Ch 1 - x, Ch 2 - y, Ch 3 - 3, Ch 4 - resultant.

Waveform Test Report

GHI SYSTEMS, INC. TRIAD CAT SYSTEM

Date	: Fri Jan 24 1992	TEST ENGINEER	: Filsinger
TEST ITEM	: f-15 Canopy, 1-man	TEST TYPE	: Drop, 17'
IMPACT LOC.	: Edge - 6,3	TEST MACHINE	: 144 deg F

Sensitivity:

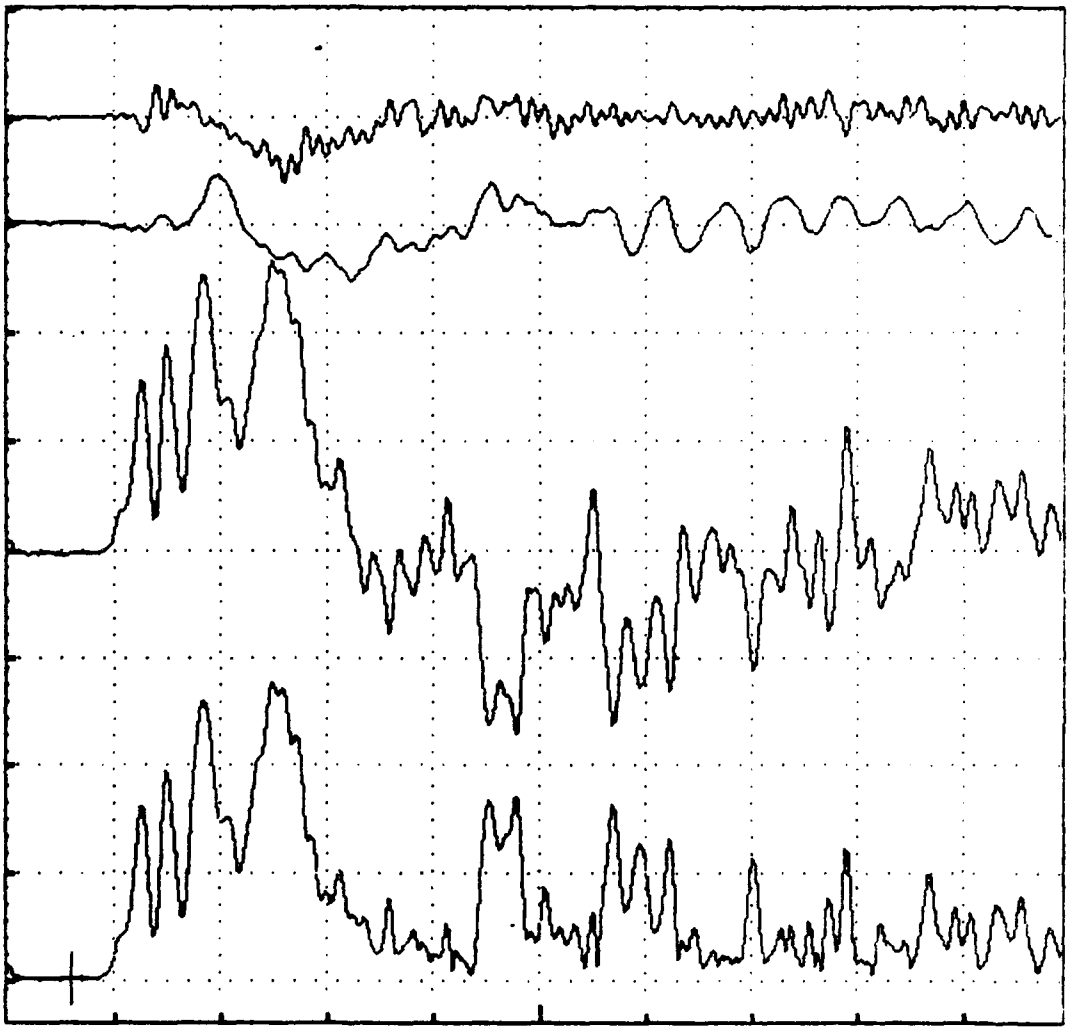
Ch. 1: 10.00 g's/Div 1
Ch. 2: 10.00 g's/Div
Ch. 3: 10.00 g's/Div
Ch. R: 10.00 g's/Div 2

Filter:

Ch. 1: 300 Hz
Ch. 2: 300 Hz
Ch. 3: 300 Hz
Ch. 4: 300 Hz

3

Trig. Ch. : ALL
Polarity : Window
Level : 3.98 g's
Mode : Single Event R
Pretrigger : 10 %



CH	TIME	CUR AMP	PEAK AMP	1ST INT	2ND INT	TIME/DIV
1	7.68 mS	0.05 g's	-0.51 g's	-0.0658 In/s		12.8 mS
2	7.68 mS	0.04 g's	0.21 g's	0.117 In/s		12.8 mS
3	7.68 mS	0.03 g's	1.03 g's	0.394 In/s		12.8 mS
■ R	7.68 mS	0.07 g's	1.21 g's	0.417 In/s		12.8 mS

Remarks

F-15 Container designed to hold 1 or 2 man canopy. One man canopy tested.
Triaxial accelerometer located on top of reinforcing rib at cg in xy plane.
Ch 1 - x, Ch 2 - y, Ch 3 - 3, Ch 4 - resultant.

Waveform Test Report

GHI SYSTEMS, INC. TRIAD CAT SYSTEM

Date	: Mon Jan 22 1992	TEST ENGINEER	: Filsinger/Moravec
TEST ITEM	: F-15 Canopy, 1-man	TEST TYPE	: Repeative shock
IMPACT LOC.	: F15-1 1:30pm	TEST MACHINE	: Mechanical Vib.

Sensitivity:

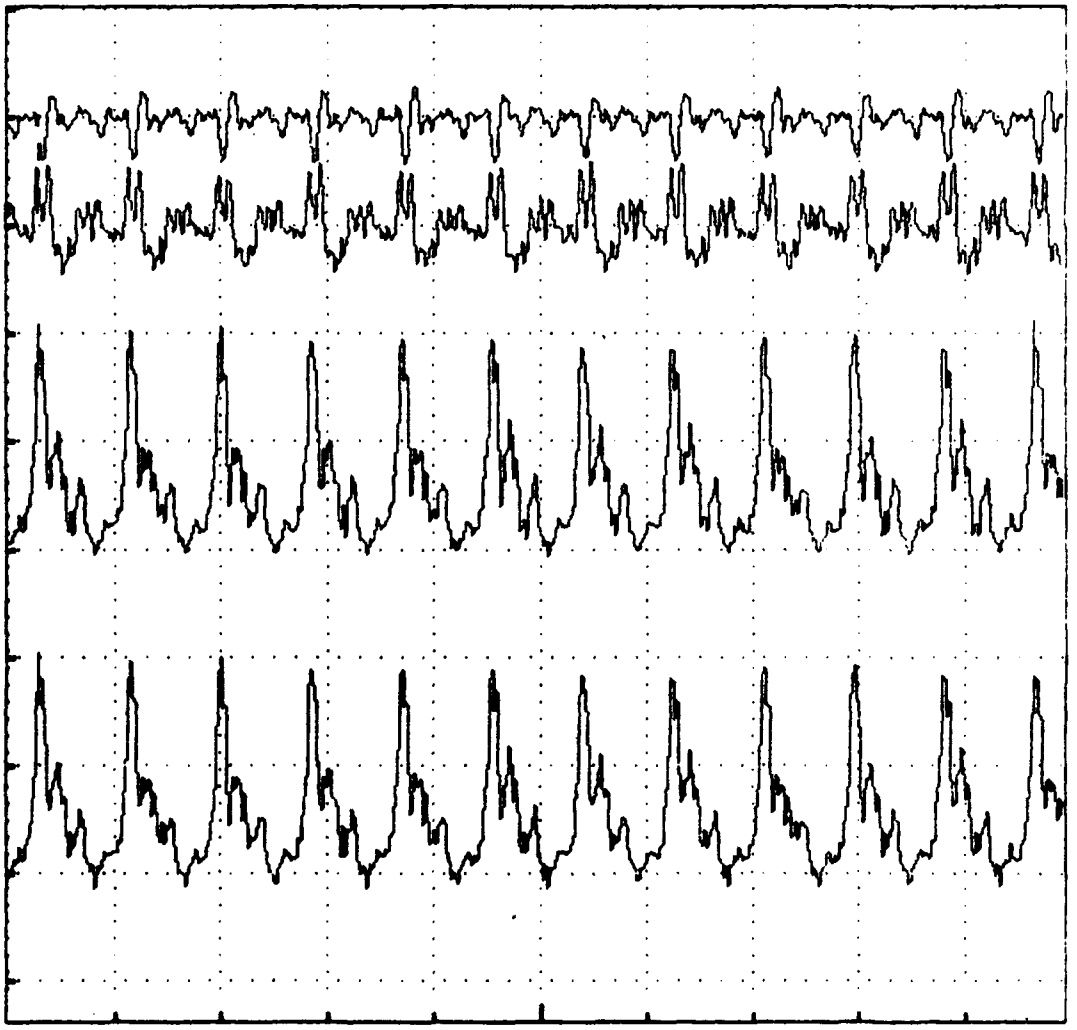
Ch. 1: 2.50 g's/Div 1
Ch. 2: 2.50 g's/Div
Ch. 3: 2.50 g's/Div 2
Ch. R: 2.50 g's/Div

Filter:

Ch. 1: 64 Hz
Ch. 2: 64 Hz
Ch. 3: 64 Hz
Ch. 4: 64 Hz

3

Trig. Ch. : ALL R
Polarity : Window
Level : 0.24 g's
Mode : Continuous
Pretrigger : 1 %



CH	TIME	CUR AMP	PEAK AMP	1ST INT	2ND INT	TIME/DIV
1	2.40 S	-0.37 g's	-0.98 g's	20.00 In/s		256 mS
2	2.40 S	0.73 g's	-1.32 g's	-172.38 In/s		256 mS
■ 3	2.40 S	4.93 g's	5.38 g's	1547.81 In/s		256 mS
R	2.40 S	5.00 g's	5.45 g's	1557.50 In/s		256 mS

Remarks

F-15 Container designed to hold 1 or 2 man canopy. One man canopy tested. MIL-STD-648, 5.3.2, Resonance Strength and Dwell Test, ambient temp. & hum. Input: Acceleration 1.0Gp. Response: Ch1 - x, Ch2 - y, Ch3 - z, Ch4 - Resultant Frequency 4.6 Hz, Repetitive Shock after 5 minutes.

Waveform Test Report

GHI SYSTEMS, INC. TRIAD CAT SYSTEM

Date	: Mon Jan 21 1992	TEST ENGINEER	: Filsinger/Moravec
TEST ITEM	: F-15 Canopy, 1-man	TEST TYPE	: Transmissibility
IMPACT LOC.	: F15-1 1:30pm	TEST MACHINE	: Electro-Hydraulic

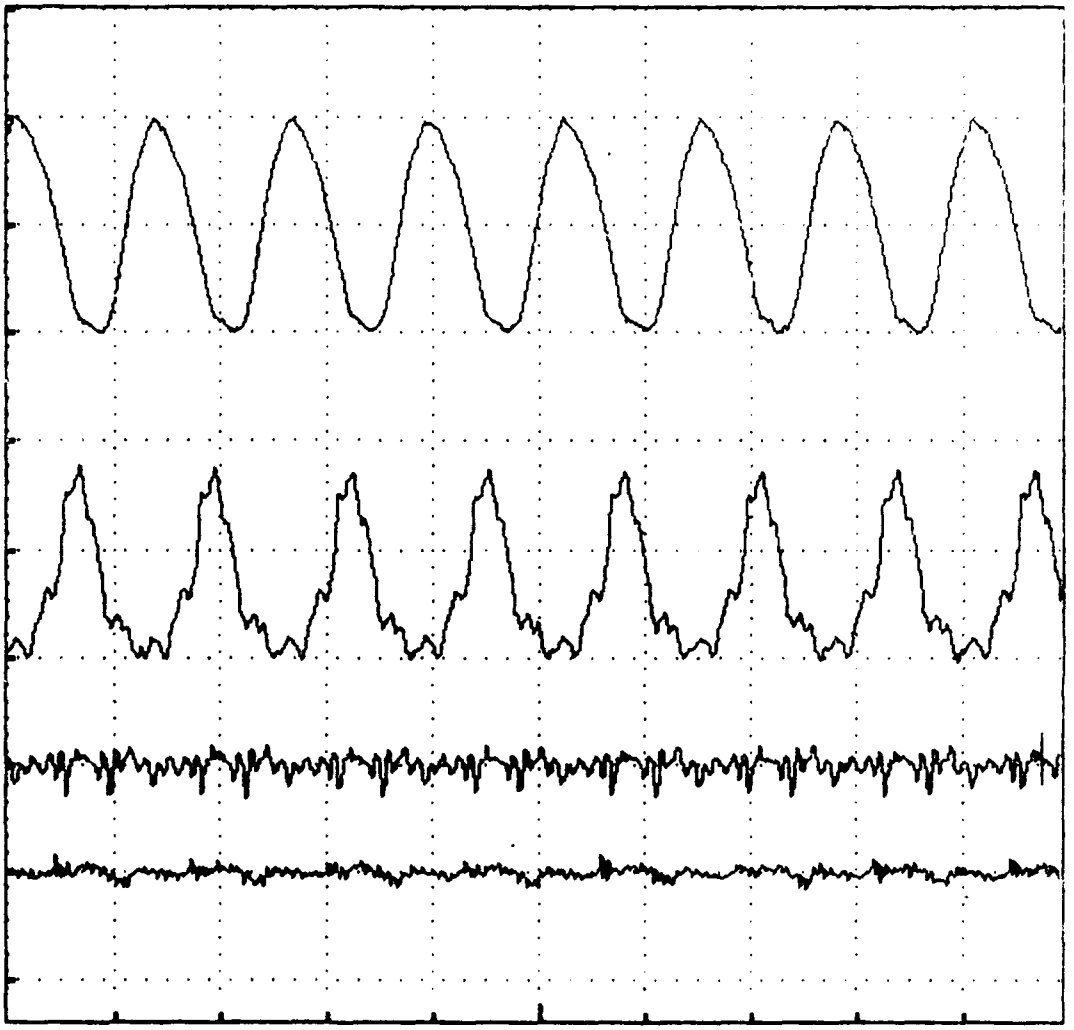
Sensitivity:

Ch. 1: 5.00 g's/Div
Ch. 2: 5.00 g's/Div
Ch. 3: 5.00 g's/Div
Ch. 4: 1.00 g's/Div

Filter:

Ch. 3: 80 Hz

Trig. Ch. : ALL
Polarity : Window
Level : 0.12 g's
Mode : [redacted]
Pretrigger : 1 %



CH	TIME	CUR AMP	PEAK AMP	1ST INT	2ND INT	TIME/DIV
1	1.52 S	0.41 g's	1.18 g's	70.70 In/s		64 mS
■ 2	1.52 S	-0.45 g's	-2.34 g's	-178.37 In/s		64 mS
3	1.52 S	6.41 g's	8.87 g's	754.19 In/s		64 mS
4	1.49 S	1.70 g's	2.01 g's	225.52 In/s		64 mS

Remarks

F-15 Container designed to hold 1 or 2 man canopy. One man canopy tested. MIL-STD-648, 5.3.2, Resonance Strength and Dwell Test, ambient temp. & hum. Input: Acceleration 1.0Gp. Response: Ch1 - x, Ch2 - y, Ch3 - z, Ch4 - Input. Frequency 12.1 Hz, Resonance Dwell - 10 minutes.

APPENDIX 3

TEST PLAN

AIR FORCE PACKAGING EVALUATION ACTIVITY
(Container Test Plan)

AFPEA PROJECT NUMBER: 91-P-117

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
140x44x39	144x48x44	1232	175/225	142.9		01 May 92

ITEM NAME: F-15 Canopy, One & Two Man

MANUFACTURER: Prototype by AFPEA

CONTAINER NAME: CNU-538/E

CONTAINER COST:

PACK DESCRIPTION: Aluminum Container

CONDITIONING: As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
1.	EXAMINATION OF PRODUCT (4.7.1)* (4.8)	Container shall be examined to determine conformance with materials, design, Table I of MIL-C-5584 and applicable drawings.	Fully assembled container.	Visual Inspection (VI)
2.	WEIGHT TEST (4.7.10)	Total tare weight of assembled container shall not be greater than 1007 lbs.	Fully assembled container lid, base and handling frame.	Scale
3.	FORM AND FIT TEST (4.7.3)	Install and remove each item in accordance with the installation and removal instructions. The container shall be inspected for form and fit. Operation of the closure fasteners and the service and maintenance facilities shall be accomplished.	Ambient. Fully assembled container.	VI

COMMENTS:
* Figures in parenthesis () refer to paragraphs in MIL-C-5584D.

PREPARED BY:	APPROVED BY:
ROBERT TEKESKY, Mechanical Engineer	TED HINDS, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER: 91-P-117

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
140x44x39	144x48x44	1232	175/225	142.9		01 May 92

ITEM NAME	MANUFACTURER
F-15 Canopy, One & Two Man	Prototype by AFPEA

CONTAINER NAME	CONTAINER COST
CNU-538/E	

PACK DESCRIPTION: Aluminum Container

CONDITIONING: As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
4.	LEAK TEST FED-STD-101 Method 5009.3 (4.7.2)	Pneumatic pressure at 1.500 ±0.018 PSI and vacuum retention at -1.500 ±0.018 PSI. After temperature stabilization, 0.025 PSI leakage is allowed over a 30 minute test duration.	Test performed in ambient condition from compressed air supply/vacuum pump.	Water manometer (WM) or pressure transducer (PT) VI
5.	VIBRATION FATIGUE TEST MIL-STD-648 Para. 5.3.2 (4.7.7.1)	Input excitation of 0.125" double amplitude or 1G whichever is less. Sweep approximately logarithmically from 5 to 50 Hz for 7.5 min. then dwell 30 min. at resonance frequency. Transmissibility shall not exceed 5 at the resonance frequency.	Rigidly attach container to exciter. Ambient.	Tri-axial acceler-ometers
6.	LEAK TEST FED-STD-101 Method 5009.3 (4.7.2)	Pneumatic pressure at 1.500 ±0.018 PSI. After temperature stabilization, 0.025 PSI leakage is allowed over a 30 minute test duration.	Test performed in ambient condition from compressed air supply.	WM or PT VI

COMMENTS:

PREPARED BY:	APPROVED BY:
ROBERT TEKESKY, Mechanical Engineer	TED HINDS, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER: 91-P-117

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
140x44x39	144x48x44	1232	175/225	142.9		01 May 92

ITEM NAME	MANUFACTURER
F-15 Canopy, One & Two Man	Prototype by AFPEA

CONTAINER NAME	CONTAINER COST
CNU-538/E	

PACK DESCRIPTION: Aluminum Container

CONDITIONING: As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
7.	<u>REPETITIVE SHOCK</u> MIL-STD-648 PARA. 5.2.2 FED-STD-101 Method 5019.1 (4.7.7.3)	Test for not less then two hours as stated in FED-STD-101 Method 5019 para. 6.3.	Ambient.	triaxial accelero-meters VI
8.	<u>LEAK TEST</u> FED-STD-101 Method 5009.3 (4.7.2)	Pneumatic pressure at 1.500 ±0.018 PSI. After temperature stabilization, 0.025 PSI leakage is allowed over a 30 minute test duration.	Test performed in ambient condition from compressed air supply.	WM or PT VI

COMMENTS:

PREPARED BY:	APPROVED BY:
ROBERT TEKESKY, Mechanical Engineer	TED HINDS, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY
(Container Test Plan)

AFPEA PROJECT NUMBER: 91-P-117

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
140x44x39	144x48x44	1232	175/225	142.9		01 May 92

ITEM NAME: F-15 Canopy, One & Two Man

MANUFACTURER: Prototype by AFPEA

CONTAINER NAME: CNU-538/E

CONTAINER COST:

PACK DESCRIPTION: Aluminum Container

CONDITIONING: As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
9.	ROUGH HANDLING TESTS (Low Temperature -20 DEGREES F)			
A.	FED-STD-101 Method 5005.1 (4.7.7.2.1) (4.7.8)	Cornerwise-drop (rotational) Test. Condition at -20° F for not less than 24 hours. Drop height 17". A loaded container of 1232 lbs. gross weight shall be used.	One drop on diagonal opposite bottom corners. Total of two drops.*	VI Thermo-couples
B.	FED-STD-101 Method 5008.1 (4.7.7.2.2) (4.7.8)	Edgewise-drop (rotational) Test. Condition at -20° F for not less than 24 hours. Drop height 17". A loaded container of 1232 lbs. gross weight shall be used.	One drop on adjacent bottom edges. Total of two drops.*	VI Thermo-couples
C.	FED-STD-101 Method 5012 (4.7.7.2.3) (4.7.8)	Pendulum-Impact Test. Condition at -65° F Temperature of shock mitigation system at time of test shall be -20° F (+0°/-10° F). Impact velocity 7 ft/sec (drop height 9"). A loaded container of 1232 lbs. gross weight shall be used.	One impact on each end. A total of two impacts.	VI Thermo-couples

COMMENTS:
* These drops are opposite those covered in test 11.

PREPARED BY:	APPROVED BY:
ROBERT TEKESKY, Mechanical Engineer	TED HINDS, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY
(Container Test Plan)

AFPEA PROJECT NUMBER: 91-P-117

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
140x44x39	144x48x44	1232	175/225	142.9		01 May 92

ITEM NAME: F-15 Canopy, One & Two Man

MANUFACTURER: Prototype by AFPEA

CONTAINER NAME: CNU-538/E

CONTAINER COST:

PACK DESCRIPTION: Aluminum Container

CONDITIONING: As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
10.	LEAK TEST FED-STD-101 Method 5009.3 (4.7.2)	Pneumatic pressure at 1.500 ±0.018 PSI. After temperature stabilization, 0.025 PSI leakage is allowed over a 30 minute test duration.	Test performed in ambient condition from compressed air supply.	WM or PT VI
11.	ROUGH HANDLING TESTS (High Temperature +140 DEGREES F)			
A.	FED-STD-101 Method 5005.1 (4.7.7.2.1) (4.7.8)	Cornerwise-drop (rotational) Test. Condition at +140°F for not less than 24 hours. Drop height 17". A loaded container of 1232 lbs. gross weight shall be used.	One drop on diagonal opposite bottom corners. Total of two drops.**	VI Thermo couples
B.	FED-STD-101 Method 5008.1 (4.7.7.2.2) (4.7.8)	Edgewise-drop (rotational) Test. Condition at +140° F for not less than 24 hours. Drop height 17". A loaded container of 1232 lbs. gross weight shall be used.	One drop on adjacent bottom edges. Total of two drops.**	VI Thermo-couples

COMMENTS:

** These drops are opposite those covered in test 9.

PREPARED BY: ROBERT TEKESKY, Mechanical Engineer

APPROVED BY: TED HINDS, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER: 91-P-117

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
140x44x39	144x48x44	1232	175/225	142.9		01 May 92

ITEM NAME: F-15 Canopy, One & Two Man

MANUFACTURER: Prototype by AFPEA

CONTAINER NAME: CNU-538/E

CONTAINER COST:

PACK DESCRIPTION: Aluminum Container

CONDITIONING: As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
11.	Cont. ROUGH HANDLING TEST (High Temperature +140 DEGREES F)			
C.	FED-STD-101 Method 5012 (4.7.7.2.3) (4.7.8)	Pendulum-Impact Test. Condition at +165° F Temperature of shock mitigation system at time of test shall be +140° F (+10°/-0° F). Impact velocity 7 ft/sec (drop height 9"). A loaded container of 1232 lbs. gross weight shall be used.	One impact on each end. A total of two impacts.	VI Thermo-couples
12.	LEAK TEST			
	FED-STD-101 Method 5009.3 (4.7.2)	Pneumatic pressure at 1.500 ±0.018 PSI. After temperature stabilization, 0.025 PSI leakage is allowed over a 30 minute test duration.	Test performed in ambient condition from compressed air supply.	WM or PT VI
13.	SUPERIMPOSED LOAD			
A.	MIL-STD-648 5.7.2 FED-STD-101 Method 5016.1 (4.7.6.1)	A prescribed load (W) shall be applied to the top of the container, in a manner simulating the stacking of similar containers. This load shall remain for a minimum of one hour. W = 19200 lbs.	Ambient, on a flat, level, rigid floor.	VI

COMMENTS:

PREPARED BY:	APPROVED BY:
ROBERT TEKESKY, Mechanical Engineer	TED HINDS, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER: 91-P-117

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
140x44x39	144x48x44	1232	175/225	142.9		01 May 92

ITEM NAME: F-15 Canopy, One & Two Man

MANUFACTURER: Prototype by AFPEA

CONTAINER NAME: CNU-538/E

CONTAINER COST:

PACK DESCRIPTION: Aluminum Container

CONDITIONING: As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
13.	Cont. SUPERIMPOSED LOAD			
B.	FED-STD-101 Method 5017 (4.7.6.1)	A load of 100 lbs/sq ft. will be distributed over the top surface of the container. This load shall remain for a minimum of one hour.	Ambient.	VI
14.	LEAK TEST			
	FED-STD-101 Method 5009.3 (4.7.2)	Pneumatic pressure at 1.500 ±0.018 PSI. After temperature stabilization, 0.025 PSI leakage is allowed over a 30 minute test duration.	Test performed in ambient condition from compressed air supply.	WM or PT VI
15.	HANDLING TEST			
A.	FED-STD-101 Method 5011.1 Para. 6.2 (4.7.5)	Forklift Handling Test. Run test as stated in Para. 6.2 of method 5011.1	Ambient.	VI
B.	FED-STD-101 Method 5011.1 Para. 6.5 (4.7.5)	Pushing Test. Run test as stated in Para. 6.5 of method 5011.1	Ambient.	VI

COMMENTS:

PREPARED BY: ROBERT TEKESKY, Mechanical Engineer

APPROVED BY: TED HINDS, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY
(Container Test Plan)

AFPEA PROJECT NUMBER: 91-P-117

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
140x44x39	144x48x44	1232	175/225	142.9		01 May 92

ITEM NAME: F-15 Canopy, One & Two Man

MANUFACTURER: Prototype by AFPEA

CONTAINER NAME: CNU-538/E

CONTAINER COST:

PACK DESCRIPTION: Aluminum Container

CONDITIONING: As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
16.	STAND-OFF TEST (4.7.5.1)	Place load one times the cover weight on the cover. The cover shall not deform or deflect. Slide cover on stand-offs five feet in each of four different directions. There shall be no damage to sealing surface or stand-offs.	Place container cover on a concrete floor resting on the stand-offs.	VI
17.	GASKET PULL TEST (4.7.5.3)	The container gasket joint shall withstand a pull test of not less than 20 Lbs. static load without any separation. Note the gasket may fail this test due to the fact it is not vulcanized. Manufactured gaskets shall pass this test during first article.	(dwg No. 9198610)	Tensile Tester or Dead weight VI
18.	COVER LIFT RING TEST (4.7.4.1)	Lift cover by one lift ring using a hoist or sling for five min. There shall be no damage or permanent deformation.	Ambient.	VI

COMMENTS:

PREPARED BY: ROBERT TEKESKY, Mechanical Engineer

APPROVED BY: TED HINDS, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY
(Container Test Plan)

AFPEA PROJECT NUMBER: 91-P-117

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
140x44x39	144x48x44	1232	175/225	142.9		01 May 92

ITEM NAME: F-15 Canopy, One & Two Man

MANUFACTURER: Prototype by AFPEA

CONTAINER NAME: CNU-538/E

CONTAINER COST:

PACK DESCRIPTION: Aluminum Container

CONDITIONING: As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
19.		HOISTING STRENGTH TEST		
A.	MIL-STD-648 Para. 5.8.3 (4.7.4)	Four Ring Hoisting Test. Hoist container loaded to five times the gross weight of a single container (6160 Lbs.) by all lift points simultaneously and leave hanging for five min. There shall be no damage or permanent deformation.	Ambient.	VI
B.	MIL-STD-648 Para. 5.8.4 (4.7.4)	Tiedown Strength Test. Apply load to each tiedown ring at an angle of 45 degrees downward from horizontal and simultaneously 45 degrees out-board from the container surface. The load shall be 3696 Lbs.	Ambient.	VI
C.	MIL-STD-648 Para. 5.8.5 (4.7.4)	Single Ring Hoisting Test. Hoist container at one lift point and leave hanging for five min. There shall be no damage or permanent deformation.	Ambient. Loaded container.	VI

COMMENTS:

PREPARED BY: ROBERT TEKESKY, Mechanical Engineer

APPROVED BY: TED HINDS, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY (Container Test Plan)					AFPEA PROJECT NUMBER 91-P-117	
CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
140x44x39	144x48x44	1232	175/225	142.9		01 May 92

ITEM NAME	MANUFACTURER
F-15 Canopy, One & Two Man	Prototype by AFPEA

CONTAINER NAME	CONTAINER COST
CNU-538/E	

PACK DESCRIPTION
Aluminum Container

CONDITIONING
As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
20.	STRUCTURAL PRESSURE TEST			
A.	MIL-STD-648 Para. 5.5.2	Container shall be pressurized to 3.0 PSI. The container shall not fail in a dangerous or catastrophic manner (i.e. loss of integrety). Loss of pressure and/or permanent deformation is acceptable.	Ambient.	WM or PT
B.	MIL-STD-648 Para. 5.5.3	Container shall be vacuum pressurized to -3.0 PSI. The container shall not fail in a dangerous or catastrophic manner (i.e. loss of integrety). Loss of pressure and/or permanent deformation is acceptable.	Ambient.	WM or PT

COMMENTS:

PREPARED BY:	APPROVED BY:
ROBERT TEKESKY, Mechanical Engineer	TED HINDS, Chief, Design Br., AFPEA

APPENDIX 4

COST CYCLE ANALYSIS

F-15 CANOPY "WOOD" CONTAINER COST ANALYSIS:

VARIABLES:

1.	No. of Containers Purchased:.....	100	
2.	Unit Cost/Container:.....	$610	
3.	Trips/Container Life:.....	10	
4.	% of Containers Placed in Storage:..	30%	
5.	% of Containers Refurbished/Year:...	30%	
6.	Time to Refurbish Container:.....	2	HRS
7.	Labor Rate to Refurbish Container:..	$12.53	
8.	Material Cost for Refurbishment:....	$25	
9.	No. of Canopies Shipped/Year:.....	115	
10.	% of Canopies Refurbished/Year Due to Deformation:.....	10%	
11.	Time to Refurbish Canopy:.....	269	HRS
12.	Labor Rate to Refurbish Canopy:.....	$14.01	
13.	Material Cost for Refurbishment of Canopy:.....	$26,000	
14.	Salvage Value/Container:.....	$0	
15.	Disposal Cost/Container:.....	$37	

CALCULATED VALUES:

16.	No. of Trips/Year:.....	1.6
17.	Average Life of a Container Which is Being Used, Not Stored (Yrs.):...	6.1
18.	Cost to Refurbish Each Container:...	$50
19.	Cost to Refurbish Each Canopy:.....	$29,769

"Wood" Container Economic Analysis:

a. Project Year	b. Container Buyes (Qty.)	c. Cost of Containers	d. O&M Costs	e. Annual Costs	f. Discount Factor (10%)	g. Discounted Annual Cost
1	100	$60,997	$1,727	$62,724	1.0000	$62,724
2	12	$7,015	$344,490	$351,504	0.9535	$335,159
3	12	$7,015	$344,490	$351,504	0.8668	$304,684
4	12	$7,015	$344,490	$351,504	0.7880	$276,985
5	12	$7,015	$344,490	$351,504	0.7164	$251,818
6	12	$7,015	$344,490	$351,504	0.6512	$228,900
7	12	$7,015	$344,490	$351,504	0.5920	$208,090
8	12	$7,015	$344,490	$351,504	0.5382	$189,180
9	12	$7,015	$344,490	$351,504	0.4893	$171,991
10	12	$7,015	$344,490	$351,504	0.4448	$156,349
11	12	$7,015	$344,490	$351,504	0.4044	$142,148
12	12	$7,015	$344,490	$351,504	0.3676	$129,213
13	12	$7,015	$344,490	$351,504	0.3342	$117,473
14	12	$7,015	$344,490	$351,504	0.3038	$106,787
15	12	$7,015	$344,490	$351,504	0.2762	$97,085
16	12	$7,015	$344,490	$351,504	0.2511	$88,263
17	12	$7,015	$344,490	$351,504	0.2283	$80,248
18	12	$7,015	$344,490	$351,504	0.2075	$72,937
19	12	$7,015	$344,490	$351,504	0.1886	$66,294
20	12	$7,015	$344,490	$351,504	0.1715	$60,283
TOTALS	319	$194,275	$6,547,028	$6,741,303	8.7734	$3,146,611

27-Aug-92

F-15 CANOPY "ALUMINUM" CONTAINER COST ANALYSIS:

VARIABLES:

1.	No. of Containers Purchased:.....	100	
2.	Unit Cost/Container:.....	$4,560	
3.	Trips/Container Life:.....	50	
4.	% of Containers Placed in Storage:..	30%	
5.	% of Containers Refurbished/Year:...	15%	
6.	Time to Refurbish Container:.....	2	HRS
7.	Labor Rate to Refurbish Container:..	$12.53	
8.	Material Cost for Refurbishment:....	$25	
9.	No. of Canopies Shipped/Year:.....	115	
10.	% of Canopies Refurbished/Year Due to Deformation:.....	0%	
11.	Time to Refurbish Canopy:.....	269	HRS
12.	Labor Rate to Refurbish Canopy:.....	$14.01	
13.	Material Cost for Refurbishment of Canopy:.....	$26,000	
14.	Salvage Value/Container:.....	$400	
15.	Disposal Cost/Container:.....	$0	

CALCULATED VALUES:

16.	No. of Trips/Year:.....	1.6
17.	Average Life of a Container Which is Being Used, Not Stored (Yrs.):...	30.4
18.	Cost to Refurbish Each Container:...	$50
19.	Cost to Refurbish Each Canopy:.....	$29,769

"Aluminum" Container Economic Analysis:

a. Project Year	b. Container Buyes (Qty.)	c. Cost of Containers	d. O&M Costs	e. Annual Costs	f. Discount Factor (10%)	g. Discounted Annual Cost
1	100	$456,000	$864	$456,864	1.0000	$456,864
2	2	$10,488	($56)	$10,432	0.9535	$9,946
3	2	$10,488	($56)	$10,432	0.8668	$9,042
4	2	$10,488	($56)	$10,432	0.7880	$8,220
5	2	$10,488	($56)	$10,432	0.7164	$7,473
6	2	$10,488	($56)	$10,432	0.6512	$6,793
7	2	$10,488	($56)	$10,432	0.5920	$6,175
8	2	$10,488	($56)	$10,432	0.5382	$5,614
9	2	$10,488	($56)	$10,432	0.4893	$5,104
10	2	$10,488	($56)	$10,432	0.4448	$4,640
11	2	$10,488	($56)	$10,432	0.4044	$4,219
12	2	$10,488	($56)	$10,432	0.3676	$3,835
13	2	$10,488	($56)	$10,432	0.3342	$3,486
14	2	$10,488	($56)	$10,432	0.3038	$3,169
15	2	$10,488	($56)	$10,432	0.2762	$2,881
16	2	$10,488	($56)	$10,432	0.2511	$2,619
17	2	$10,488	($56)	$10,432	0.2283	$2,382
18	2	$10,488	($56)	$10,432	0.2075	$2,165
19	2	$10,488	($56)	$10,432	0.1886	$1,967
20	2	$10,488	($56)	$10,432	0.1715	$1,789
TOTALS	144	$655,272	($209)	$655,063	8.7734	$548,384

Explainations of Values:

16. Number of Trips per Year =
(Number of Canopies shipped per Year)/
(Number of Containers not in storage)

17. Average Life of A Container = (Number of Cycles per
Container Life)/(Number of Trips per Year)

18. Cost to Refurbish Each Container = (Number of Hours
Required to Refurbish One Container)*(Hourly Labor Rate)+
(Cost of Materials; Wood, Nails, etc.)

19. Cost to Refurbish Each Canopy = (Number of Hours
Required to Refurbish One Canopy)*(Hourly Labor Rate)+
(Cost of Materials; Glass, Rivits, etc.)

b. Container Buyes = (Number of Containers not in Storage)/
(Average Life of a Container)

c. Cost of Containers = (Number of Containers Bought in a
Given Year)*(Unit Cost per Container)

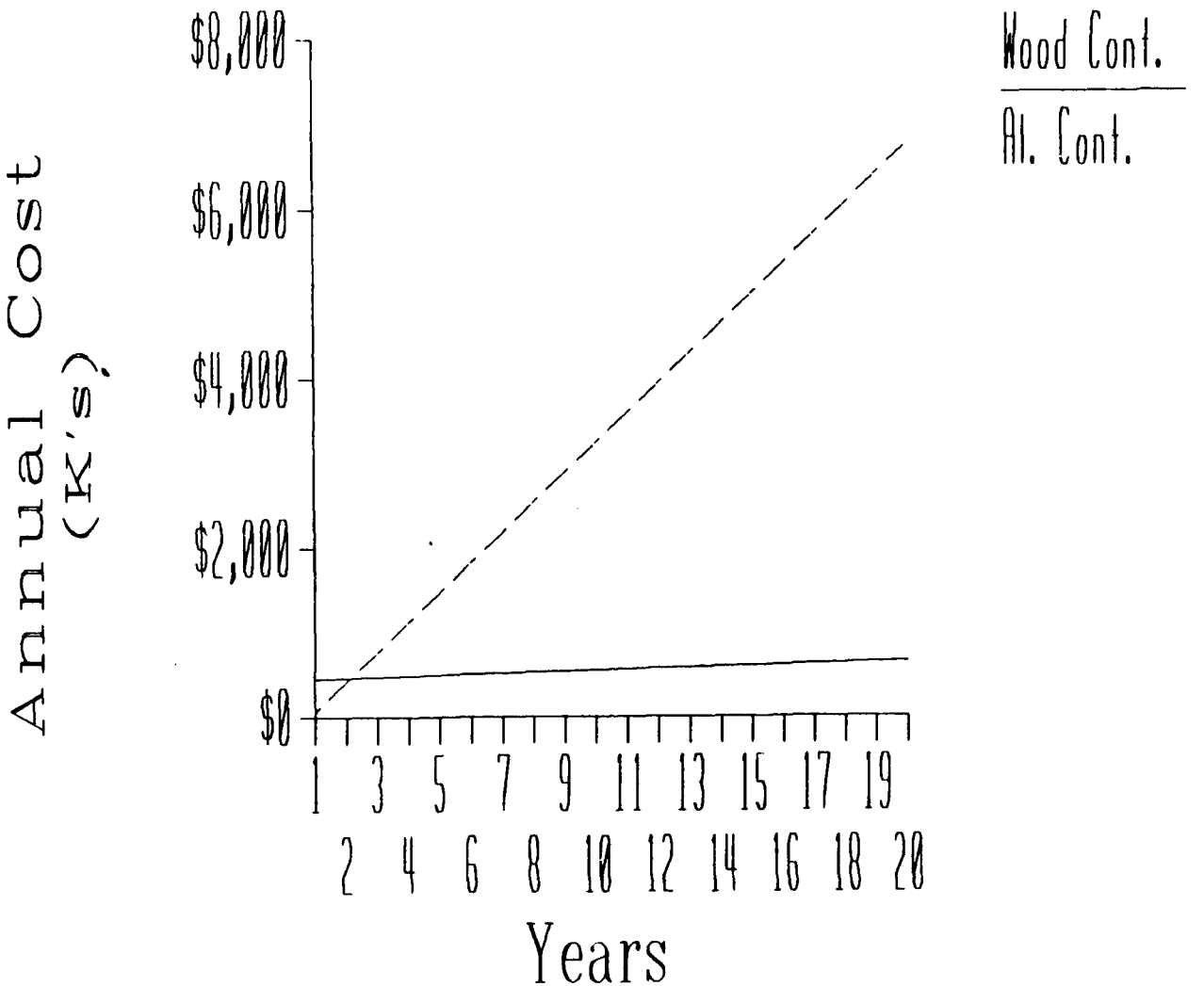
d. O&M Costs = (Number of Containers Refurbished)*
(Refurbishing Rate per Container)*(Number of Trips per Year)+
(Number of Canopies Refurbished)*(Refurbishing Rate per
Canopy)+(Number of Containers Disposed of)*(Disposal Cost
per Container)-(Number of Containers Salvaged)*(Salvage Rate
per Container)

e. Annual Costs = (Cost of Containers)+(O&M Costs)

g. Discounted Annual Cost = (Annual Costs)*(Discount Factor)

Annual Cost

Over 20 Years



APPENDIX 5

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APPENDIX 6

REPORT DOCUMENTATION

REPORT DOCUMENTATION PAGE

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11. TITLE (Include Security Classification)
Design and Qualification Testing of the CNU-538/E Container for the F-15 Canopy.

12. PERSONAL AUTHOR(S)
Robert S. Tekesky

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
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16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	CNU-538/E, F-15 Canopy, Aluminum Container, Reusable Container, Design, Test, Container

19. ABSTRACT (Continue on reverse if necessary and identify by block number)
This report is to document the design and qualification testing of a aluminum container, CNU-538/E, for shipping/storing F-15 canopies. The CNU-538/E will replace the current wooden container. The CNU-538/E will store either the one man canopy or the two man canopy, prevent deformation of the canopies, and have a longer life cycle with less maintenance to the container and canopies. The CNU-538/E is a reusable, welded aluminum, controlled breathing style container for level A packaging. The CNU-538/E container was tested to qualify the container for production release by the Air Force Packaging Evaluation Activity. The design and tests were in accordance with MIL-STD-5584, MIL-STD-648, and FED-STD-101 and completed at the Air Force Packaging Evaluation Activity, Wright-Patterson AFB OH 45433-5999.

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